

APRIL/MAY 2024

**DPH31/GPH31 — CONDENSED MATTER
PHYSICS**

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.



1. What are Miller Indices?
2. Define Structure factor.
3. State Phonon momentum.
4. What are the merits and demerits of Einstein model?
5. What is mean by semiconductor?
6. Define Hall effect.
7. State Hund's rule.
8. What are ferromagnetic domain?
9. What are Transition temperature in superconductor?
10. Write any three applications of SQUIDS.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) Derive the Bragg's law of crystal diffraction.
Or
(b) Write a short note on Brillouin zone.
12. (a) Derive an expression for the frequency of lattice vibrations of monoatomic lattices.
Or
(b) Explain in details inelastic scattering by phonons.
13. (a) Derive Wiedmann-Franz law.
Or
(b) Derive an expression for intrinsic carrier concentration of a semiconductor.
14. (a) Describe the Quantum theory of Paramagnetism.
Or
(b) Write a short note on (i) Bloch Wall (ii) Magnons
15. (a) Explain Isotope effect on Superconductors.
Or
(b) Derive the London equations of Superconductors.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Calculate the atomic radius, packing factor and coordination number of SC, BCC and FCC structures.
17. Derive an expression for the specific heat of solids on the basis of Debye's model. How does the Debye's model differ from Einstein model?
18. Describe the Kronig-Penny model utilizing Bloch theorem.
19. Describe the Heisenberg's interpretation of Weiss field.
20. Discuss BCS theory on superconductivity w.r.t. Cooper Pairs.

